Evaluating the Sensitivity of Screening-Level Vapor Intrusion Models

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Vapor intrusion is defined as the migration of volatile chemicals from the subsurface into overlying buildings. Volatile organic contaminants (VOCs) in soil or groundwater can volatilize into soil gas and be transported towards the land surface where it can enter homes or businesses through cracks in basement floors or slabs. These volatile compounds are frequently associated with contamination from leaking underground storage tanks and releases from dry-cleaners and industrial facilities.

Under certain circumstances, people living or working above contaminated soil or groundwater may be exposed to harmful levels of these vapors. Often, a screening-level model is employed to determine if a potential indoor inhalation exposure pathway exists and, if such a pathway is present, whether long-term exposure increases the occupants' risk for cancer or other toxic effects to an unacceptable level. A popular screening-level algorithm for making such determinations is the Johnson and Ettinger (J&E) model. The EPA Office of Emergency and Remedial Response issues eight spreadsheet variations of the basic J&E model through their website (http://www.epa.gov/superfund/programs/risk/airmodel/johnson_ettinger.htm). Although the J&E model is appealing because of its simple nature, there are unanswered scientific questions concerning its application:

- Does the model consistently produce the "conservative" results necessary in deciding upon further action?
- How important are the choices of various input parameters?
- Would changes in basic assumptions significantly change model outputs?

To answer these questions, a web-based version of the model is being developed (http://www.epa.gov/athens/onsite) so that the sensitivities and uncertainties of this model can be assessed. A new decision-tree structure drives the model input process, requesting information from the user and selecting subsequent data and models based on user response. This approach to using the model is designed not only to answer the scientific questions by providing best estimates of indoor air concentration, but also to provide upper and lower concentration bounds based upon the ranges of possible inputs. Where multiple conceptual formulations of the model can be used, the analysis also evaluates the sensitivities introduced by the choice of model itself. These results are expected to provide an improved basis for the use of models in a risk screening protocol.